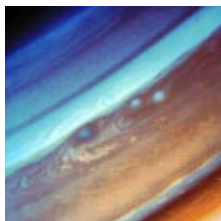


Focus on Saturn's Fascinating Features

Saturn's cloud layers hold many subtle details.



LESSON TIME

Two parts of 40 minutes each.

PREPARATION TIME

30 minutes

MATERIALS

For the teacher:

- "The Ringed World of Saturn" script
- Stapler

For each student:

- Black construction paper; crayons
- Copy of "The Layers of Saturn" book pages
- Scissors; paper clips
- Silver glitter glue (optional)
- Science Notebooks

STUDENT PREREQUISITES

Students should have some basic background information about Saturn's moons.

LESSON NO. 9

Language Arts Focus — Writing and Illustrating Expository Texts

Science Focus — Creating Saturn Books: Rings, Moons, and Other Features

OVERVIEW

Students will create a multilayered book with diagrams of Saturn showing its various layers, ring system, and many moons. To enhance background information on Saturn, students will practice listening to informational text. Students will also create their own texts to support and explain their Saturn diagrams. A teacher classroom script, "The Ringed World of Saturn," containing background information with age-appropriate language, is provided for this lesson (see page 5).

BACKGROUND

Saturn is often referred to as the "jewel of the solar system." Its striking rings and numerous icy moons set it apart from the other planets. It is important for students to understand that planets have distinct features that make them of particular interest to scientists and motivate our ongoing planetary exploration. Cassini-Huygens mission scientists will be exploring Saturn's atmosphere to learn more about its temperature, cloud properties, structure, and rotation. The configuration of Saturn's rings, their sizes, and the distribution of material within them are also being studied by scientists. The icy satellites that orbit Saturn are under investigation as scientists explore satellites embedded in the rings and their composition. This lesson introduces students to several of Saturn's exciting features — features of particular interest to scientists that capture the imagination of all.

Objectives

Students will:

1. Write with accuracy to characterize Saturn and its features.
2. Create a multilayer book about Saturn.
3. Create diagrams of Saturn with rings and moons.



Teacher Preparation

Print out a copy of “The Ringed World of Saturn” script (two pages) to read to the students during discussion prior to the writing activity. Make copies of “The Layers of Saturn” book pages (five pages plus cover page), one set per student. Provide for each student one sheet of black construction paper, 8-1/2 x 11 inches.

Procedure

Part One

Creating the Book Pages — 40 minutes

(Depending on the ages of your students, this may take two days)

1. Distribute one set of “**The Layers of Saturn**” book pages plus one piece of black construction paper to each student. The black paper will serve as the back cover of the students’ books.
2. Model how to cut each of the pages for your students.
3. Have students use crayons to color the various pages of Saturn. Use pictures of Saturn from books, the Internet, posters, or newspapers to give the students a rich picture of what Saturn looks like. For excellent images, visit:
<http://saturn.jpl.nasa.gov/multimedia/images/index.cfm>
4. Explain to students that the colors they see in pictures of Saturn and its rings are often enhanced or color has been added to the images to bring out details. Suggested colors for the pages are as follows:

<u>Page</u>	<u>Features of Saturn</u>	<u>Colors</u>
1	Rings	Light brown
2	Surface	Yellow or tan with wide brown stripes
3	Rocky Core	Orange
4	Metallic Hydrogen Gas	Orange and brown
5	Hydrogen Gas	Yellow

5. Have students write their names on the covers on the “By” line.
6. Give each student a paper clip to keep their pages together. Remind them to use the numbers on the pages to keep them in order.
7. If you are using optional silver glitter glue, put a small amount of it on the rings and ask students to spread it around the rings to make them look icy.
8. Have students put their names on the back of the black construction paper.
9. Ask students to put the frozen moons of Saturn on the inside of the back cover. They can be labeled. Don’t forget that Titan is the largest!
10. To add stars to the background, students can dot a small amount of glitter glue to the top half of the black construction paper (very cool!).
11. Set the pages aside to dry.

teacher

TIP

Most of Saturn’s moons orbit along the plane of the rings, but Phoebe does not. It orbits outside the ring plane and also orbits in opposition to the rest of the moons!



teacher

TIP

If your students are writing independently, ask each student to make his or her own sentences. If your students are just beginning to write, support their writing by working as a whole class.

Part Two

Writing the Book — 40 minutes

1. Return the pages of the books to students.
2. Ask them to listen very carefully to what you are about to read about Saturn (using “The Ringed World of Saturn” script).
3. Tell them that together you are going to make sentences about Saturn to write in their books.
4. After you have read about each of Saturn’s features, stop and do your writing — either as a shared or independent writing activity.
5. When the writing is complete, staple the pages along the left edge of the bottom half of the black construction paper.
6. Slip the planet into the rings and the book is complete.
7. Students can read their books to each other or make presentations to other classrooms.

Using Science Notebooks

Writing prompts for this lesson:

1. Focus questions: What is Saturn’s system like? Would you like to visit Saturn? Why?
2. Process question: What activities did you do to learn more about what Saturn is like?

Why This Works

The strongly visual nature of the book’s diagrams enhances student learning. As students create this multilayered book, they learn in a very hands-on way that Saturn is multidimensional. When you open the cover, you see Saturn and its ring system. As you continue reading the book, you also see a cut-away section of the planet showing the layers in various colors. The final page places Saturn in its context, surrounded by frozen moons in the darkness of space.

Student writing and reading of the book further reinforces the idea that Saturn is a complex planet at the center of larger system. The unique quality of this book will compel students to share it with family and friends, thus repeating and reinforcing the main ideas being learned.

Assessment

Students’ writing and drawings, and entries in their Science Notebooks, will indicate how well they have grasped the main features of Saturn.

Here are some sample sentences to show what successful student writing may look like:

- The rings: Saturn has rings. The rings are icy. The rings are big. The rings have gaps. One is the Cassini Division.



- The surface: Saturn is cloudy. Saturn is windy. The wind makes Saturn look striped. Saturn's winds are fast.
- The rocky core: The core is hot. It is molten rock. So is Earth's core.
- Hydrogen gas layer: The first layer of gas is hydrogen gas. Saturn has gases. You cannot stand on Saturn.
- Metallic hydrogen gas layer: Saturn is made of different gases. This layer is hot. The gases spin fast on Saturn.

Standards

NCTE Standards for the English Language Arts

- Students read a wide range of print and nonprint texts to build an understanding of texts, of themselves, and the world.
- Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), and genre to create, critique, and discuss print and nonprint texts.
- Students participate as knowledgeable, reflective, creative, and critical members of a variety of literacy communities.
- Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning for enjoyment, persuasion, and the exchange of information).

National Science Education Standards

Physical Science

- Position and motion of objects

Earth and Space Sciences

- Objects in the sky



Teacher Background Information and Classroom Script



The Ringed World of Saturn

Saturn is the sixth planet from the Sun. Because it is so far from the Sun, it doesn't get much sunlight and it is very, very, very cold! It is much sunnier and warmer on Earth. Don't worry about getting a sunburn on Saturn!

Saturn moves much slower in its orbit around the Sun than Earth does. It takes Earth one whole year — 365 days — to go all the way around the Sun. But it takes Saturn almost 30 Earth years to go all the way around the Sun! That's a long, long time.

The first thing most people notice about Saturn is its very special rings. They are very, very big. Saturn is far, far away from us — so far, in fact, that Saturn looks a lot like a small speck of light in the sky. When the Cassini spacecraft is close to Saturn and its rings, we will find out many new things about Saturn and what is around it.

Let's begin our trip to Saturn.

Imagine you are the Cassini spacecraft and you have been on the very, very long trip to Saturn. The trip from Earth to Saturn takes about 7 years, traveling day and night! Space is a very, very big place! After being in space for all that time, you see a beautiful planet in the distance. As you get closer, you realize it is a huge gas planet with rings. What do you think it is? It's Saturn!

First Stop — The Rings

You might think there are only two rings around Saturn, but hundreds of rings combine to form the ring system of Saturn. Scientists use letters to name the rings, and they have named 7 ring zones so far. We can see some of the rings from Earth using telescopes. We can observe the outer zone, called the A ring, and the brighter, inner zone called the B ring. The big space between the A and B rings is called the Cassini Division.

The rings are very wide, but very thin! Some of the rings look like they are braided — they are pretty complicated. Some of the rings even look twisted. There are also some small moons in the rings.

The rings are made mostly of chunks of water ice and ice-covered rock. Some of the chunks are small and some are pretty big — some are the size of a grain of sand, some are as big as a house. The rings do not stay in one place, but orbit Saturn, just like Earth orbits the Sun. Things are really moving in space!

Saturn's Surface

Saturn is covered with thick clouds. The top layer of the clouds is very cold. We have seen big storms in Saturn's clouds. It is very windy on Saturn. The clouds



move and make Saturn look striped. The moving clouds give Saturn the swirling yellow and gold cloud bands that we see. Saturn also has big white spots. Scientists think the white spots may be big storms.

Now let's look past the clouds at Saturn's core and its gas layers.

Saturn's Core

The very center of Saturn is called the core. Scientists think that Saturn has a rocky, molten core. Molten means melted — the center is made of liquid rock. Earth's core is also made of molten rock. Why do you think it is liquid rock? The reason is, it is very, very hot and rock that is so hot melts into a liquid, like lava from volcanoes here on Earth.

Saturn's Inner Layer — Metallic Hydrogen Gas

Except for the core, Saturn is made of lots of gas. One of the inner layers of Saturn is made of a gas or liquid called hydrogen (when it is hot and deep inside the planet there is no difference between gas and liquid.) Don't forget we are still pretty close to the core of Saturn and it is very, very hot! Saturn isn't very dense because it is made mostly of hydrogen. If you ever got close to Saturn, you could put your hand right through it. Remember, Saturn is not solid like Earth, but a big ball of gas and liquid. You would sink into Saturn if you ever visited it. Scientists want to know more about the gases on Saturn.

Saturn's Outer Layer — Hydrogen Gas

We find hydrogen gas in lots of places in the solar system. Not all parts of Saturn move at the same speed. When Earth spins, it all moves together because it is solid. (Remember, the water in the ocean is sloshing around on solid ground!) When Saturn spins, some parts move faster and some parts move slower-because it is made of gas. Isn't that surprising?

Saturn's Neighbors

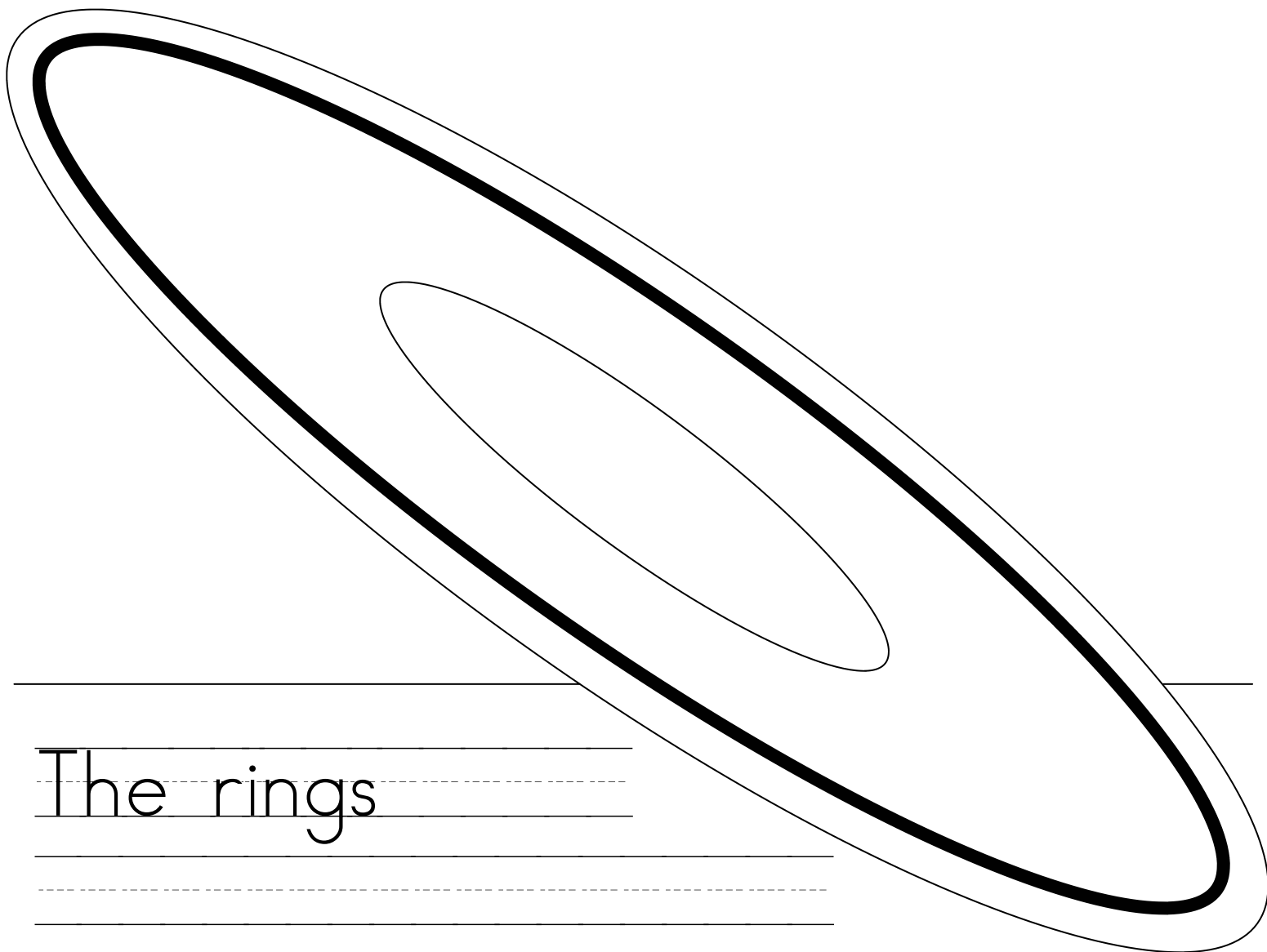
Saturn is not in space all by itself. Many icy, frozen moons orbit around Saturn. Some of the moons are in the rings, but most of them are a little farther from Saturn. Earth has only one moon, but Saturn has 18 moons with interesting names, and scientists have discovered many more. We think there may be more than 31 moons around Saturn. It's kind of crowded up there with all those moons. Saturn's biggest moon is named Titan.

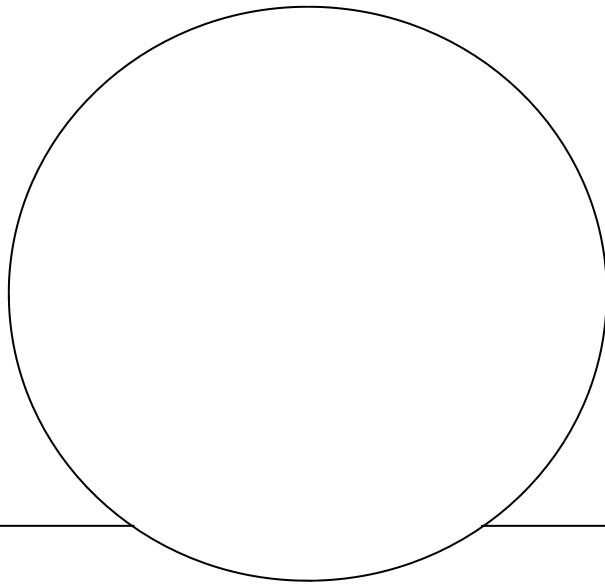
Can you think of something else that is in the sky? (Hint — we see them twinkle at night.) Stars! The stars are really far away from Saturn, but we can still see their light as they shine in the sky.



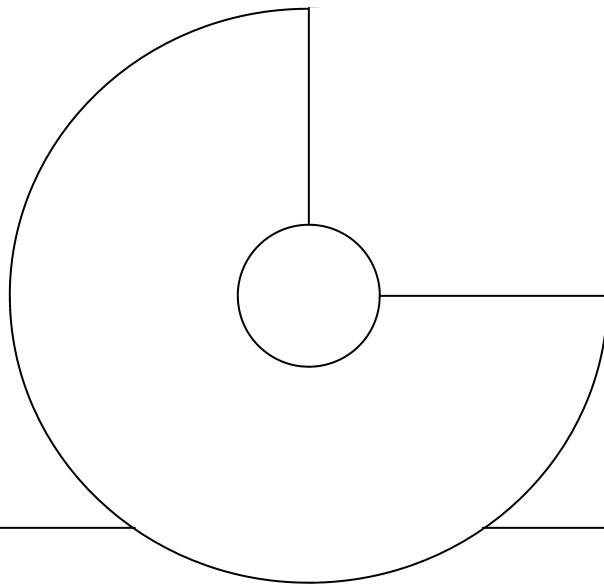
The Layers of Saturn

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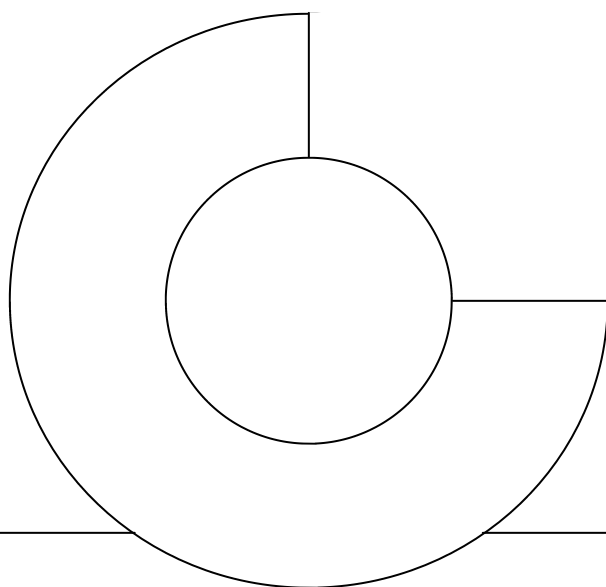




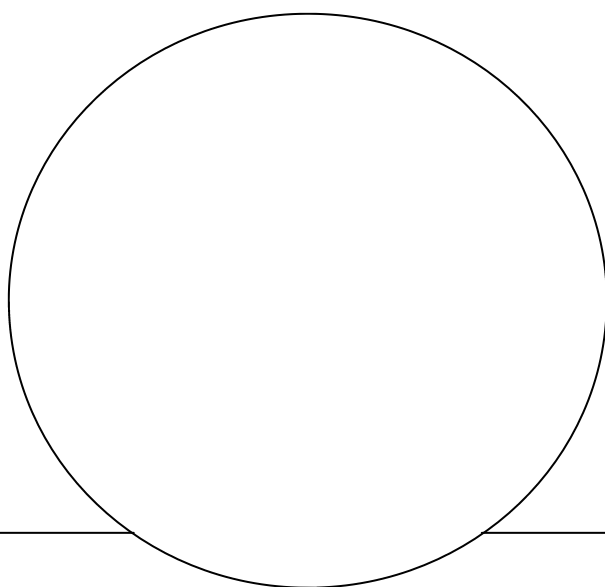
The surface



The rocky core



Metallic hydrogen gas



Hydrogen gas